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ETIOLOGY OF DENTAL CARIES.

ACIDS OR GERMS; WHICH?

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[Read before the New England and Conn. Valley Dental Societies, October, 1882.]

During the last few months some notable papers and reports have appeared, regarding the causes of dental decay, which are eminently worthy of more than passing interest. Some of these papers are more suggestive than otherwise; while others treat the subject with quite positive assertion, being supported by a variety of experiments that seem to give a substantial basis for the assertions made. With the claims of those who hold to the "acid theory," you are too familiar to render a reiteration of the same at all necessary.

I propose in this report a simple summation of some of the investigations recently made, most of which have already been given to the public in one form or another.

In the first place I wish to quote from a very interesting paper read before the Illinois Dental Society, a little more than a year since, by

Dr. C. W. Spalding of St. Louis. He says: "In common, I believe, with many other practitioners, I have supposed that an acid condition of saliva prevails, or at least may usually be looked for in most cases of *rapid* decay of the teeth. Under this impression I entered upon a series of chemical tests with a view of endeavoring to discover the *cause* of this assumed chemical condition of saliva.

My observations have resulted in the formation of an opinion amounting almost to a conviction, that the agency heretofore ascribed to the chemical condition of saliva in promoting decay of the teeth in healthy persons, has been largely over-estimated, if it has not been altogether erroneous. My first experiments were made upon the saliva of a young girl—aged 12—whose teeth were decaying rapidly, so much so that fillings previously inserted, that is, before the case came into my hands, whether of gold or other material, had lasted but a short time, and in whose teeth *new* cavities were constantly forming, and this at so rapid a rate that cavities of considerable size would form in the space of a few months, notwithstanding pretty thorough cleanliness and good general care.

I looked to find an *acid reaction of the saliva* in this case, and had been reflecting on a course of medical treatment having in view the correction of this supposed condition of the saliva.

What, then, was my surprise on finding, after repeated tests, that the saliva of this young person exhibited in every test either a neutral or a slightly alkaline chemical reaction! In no one of a large number of tests was there any, even the smallest acid reaction shown.

I immediately sought other cases where a similar destructive process was going on, but the result in each was precisely the same as in the case just narrated.

A professional friend also made similar tests in some very marked cases of rapid decay with the same results—no acid condition of the saliva revealed. . . . . .

The view I now present is, if the general health is good or fair, and the saliva normal or nearly so, any rapid decay of the teeth *must be attributed to some other cause than an acid saliva.* In certain localities favoring the lodgment and retention of food, decomposition of food substances probably takes place accompanied perhaps by the generation of an acid. But many of the cavities of the class now under consideration are located at points very unfavorable to retention, and it would not be fair to assume that decay occurring at these points was occasioned by products resulting from either the partial digestion,

the oxidation, or any other change in food substances. . . . . Are there any other known methods by which *acids may be generated*, to whose action this rapid decay of the teeth may be fairly attributed? Let the *chemists* answer! If yes, the methods should be sought out and explained, that the *chemical* theory, as it relates to this class of cases, may be fairly presented. If, however, the chemical theory is found, on thorough investigation, to be inadequate to the production of this class of cavities, or of any cavities under the conditions I have presented, some other cause must be invoked."

This paper of Dr. Spalding was read before the above-named Society in May, 1881, and is mainly suggestive in its nature, evincing, however, a *questioning* attitude, at least, in regard to the "acid theory."

In the following month of August a paper was read before the International Medical Congress, giving the results of "An investigation into the effects of *organisms* upon the teeth and alveolar portions of the jaw," by Arthur S. Underwood, M. R. C. S., L. D. S., and W. J. Milles, L. R. C. P., F. R. C. S., and C., that is of quite a different nature, and affords an answer to some of the queries of Dr. Spalding; how satisfactory to him, however, I do not know. This report was published in the Journal of the British Dental Association, and republished in this country by the Missouri Dental Journal, and the New England Journal of Dentistry of May, 1882.

If any gentleman present has failed to read and re-read this report I venture to most seriously urge him to secure a copy of either of these journals containing it, and, until he can *disprove* the statement of experiments and observations therein given, take down from the shelf of accepted facts the old dusty "creed" of "acid theory," and write upon it, "*re-opened for further investigation.*"

I said that this report differs from the paper from which the preceding quotations were made; that the first is suggestive and questioning. In the preface to this report, by these English scientists, they offer as the one only apology for venturing to present it before so illustrious a body, "a firm and rooted belief in the truth of our theory, and a hope, amounting to a conviction, that it will prove serviceable to humanity."

They announced as the object of their inquiry—undertaken some four years previously—"to determine, as far as possible, to what extent *germs* are present in the dental tissues when in a state of disease and to deduce conclusions as to the *effects* of their presence."

Their methods of experimentation are stated to be "three-fold." 1st, Microscopical; 2d, Flask experiments; and, 3d, Clinical experiments.

They state that "The results of this three-fold investigation have uniformly led us to the conviction that *germs* play an important part in the *production* and *maintenance* of morbid conditions of the dental tissues. . . . With regard to the purely chemical theory, we cannot accept it as wholly satisfactory, for the following reasons:

1. Because the destruction of dentine, effected by the action of acids alone, under *aseptic* conditions, does not resemble caries, either in color or in consistency, it being colorless and gellatinous, the process uniformly attacking all parts of the surface.

2. Because sections of dentine so destroyed show *uniform destruction of the matrix*, but not *enlargement* of the *channels* occupied by the *fibrils;* whereas, true caries first attacks the *soft tissue*, i. e., the *fibrils*, and encroaches from that *point d' appui* upon the surrounding calcified structure, thereby producing the characteristic enlargement of the channels, until two channels break into one, the intervening matrix being wholly destroyed.

3. That, although artificial caries have been produced exactly resembling true caries, we have failed to discover any record of an experiment in which this has been the case where septic influences were excluded. . . . . .

4. We would urge that when caries occurs in the mouth, it is always under circumstances more favorable to the action of germs than to that of acids. There is always, first of all, a minute pit or haven where germs can rest undisturbed and attack the tissues. We cannot, upon the purely acid hypothesis, explain why the same acids that originally caused the decay, gaining access through some minute imperfection of the armor of enamel, do not in the same mouth, or under the same conditions, attack the wounded enamel at the edges of the filling. The germs cannot rest there, they are constantly washed away if the surface is fairly smooth; but the acids literally bathe the part except during the performance of the act of mastication, when the alkaline parotid and submaxillary saliva neutralize their action.

These considerations led us to seek for signs of the presence of organisms in carious dentine, with results that far exceeded our expectations.

This theory—which, for the sake of distinction, may be called 'septic'—is rather an amplification of the chemical theory than a contradiction of it. Most probably the work of decalcification is entirely performed by the action of acids, but these acids are, we think, *secreted by the germs themselves*, and the organic fibrils upon which the organisms feed, and in which they multiply, is the scene of the manufacture of their characteristic acids, which, in turn, decalcify the matrix, and discolor the whole mass. . . . . The sections from which our observations have been made, have been cut from fresh teeth, very shortly after extraction, and without any decalcifying or softening re-agent.

We have subsequently stained them with an aniline dye—methyl violet—following as closely as possible the process recommended by Koch, a process which renders micrococci fairly distinct under a one-eighth lens, with proper illumination. . . . . In dentine, which has occupied most of our attention, we have *invariably* discovered the channels containing the dentinal fibrils more or less infiltrated with germs—for the most part micrococci, oval and rod-shaped bacteria. The germs we find penetrating, at first in Indian file, then more thickly along the course of the fibrils.

As they accumulate and choke up the channels, they encroach upon the matrix, diminishing the distance between the fibrils until the matrix entirely disappears, the neighboring channels join, and the whole tissue becomes *one conglomerated mass of organisms*. Beyond the sphere of *visible* decay, sections cut from apparently healthy tissue show here and there a narrow line of micrococci or bacteria, like an advance guard, and such isolated tubes or germs probably penetrate far into tissue which the naked eye would pronounce sound.

In decay which has appeared in blocks of ivory worn on a plate, we have observed very similar appearances, also *in some caries which we have produced ourselves* in a flask, by exposing a sound tooth to *septic agencies*.

In cementum hitherto we have experienced some difficulty in obtaining sections of tissue into which caries has penetrated; but where we have succeeded, we have found the lacunæ filled with germs. In some lacunæ, the protoplasm of the osteoblast cell is slightly stained, the nucleus very deeply, and a few germs are scattered about in little groups. In others, the protoplasmic contents of the space appear to have been totally destroyed, the outline lost, and the whole lacuna crowded with germs."

A considerable portion of the report by these gentlemen is a statement of experimentation and observation relative to the action of germs upon the *pulp* of teeth, and in alveolar abscesses, for which I must refer you to the published article.

A brief summary of the report, in so far as it relates to the etiology of decay of the teeth, is as follows:

"We consider that caries is *absolutely dependent* upon the presence and prolification of organisms. That these organisms attack first the organic material, and feeding upon it, create an acid which removes the lime-salt, and that all the differences between caries and simple decalcification by acids is due to the presence and operation of germs."

Let me recall your attention, right here, to Dr. Spalding's inquiry, viz: "Are there any other known methods by which *acids may be generated*, to whose action this rapid decay of the teeth may be fairly attributed? Let the *chemists* answer."

It is also interesting to note that, while Dr. Spalding was engaged "on this side of the water," in a series of investigations which led him to substantially abandon the "acid theory," and to call upon the *chemists* for "further light," two gentlemen, at least, on the *other* side were, at the same time, engaged in a long series of scientific investigations which resulted, three months thereafter, in the promulgation of, at least, a *theoretical* answer to his question.

As far as is known to the writer, these gentlemen stand alone in the presentation of a theory that the *inorganic* portions of the teeth are destroyed by a *peculiar* acid which has its *origin* in the operations of germs upon the *organic fibrils*. I find, however, that something like this is hinted at as *possible* by Prof. Tyndall's writing on allied subjects.

The conclusion is inevitable from a careful study of this report, that if the *germs* are excluded, there can be no decay—provided, of course, they have demonstrated the truth. But we must proceed.

In October of last year, two months after the presentation of the above report to the Medical Congress, Prof. Charles Mayr, a scientific chemist of large experience and culture, presented a paper before the Connecticut Valley Dental Society, in which he incidentally alludes to some of the theories of chemical action in decay of the teeth and declares them to be *unscientific*.

This quotation being attacked by Dr. Watt, of the Ohio State Journal, as being an evidence of a lack of knowledge of the causes of dental decay on the part of Prof. Mayr, called out a reply from the

latter—Prof. Mayr—in which he says, "*I consider decay a physiological process.* . . . Decay is an *ulcer* only modified by the difference of tissue. The chief factor probably in *starting*, and more probably *maintaining* of the ulcer are *low organisms* belonging to the protists, like bacteria, leptothrix, etc. *The lime-salts are not dissolved*, or, at least, only a fraction, but are *carried away* and *comminuted mechanically*."

This conclusion of Prof. Mayr is based upon a study of chemical facts in relation to dentistry covering several years, during which a large number of experiments and chemical tests have been made, in which it was found in every case "that the lime-salts are only slightly diminished in the decayed mass compared with the healthy tissue."

Furthermore his experiments show "that the chief chemical difference between healthy and decayed dentine is at the *outside*, not at the *boundary line* of decay. . . . That the lime-salts were the same in the decayed masses as in the healthy dentine—carbonates and phosphates."

Thus it will be observed that the "chemists" *were* already at work before Dr. Spalding propounded to them his query, and that they have rather more than answered his question.

The two English chemists referred to, and Prof. Mayr substantially agree that the presence of *germs* is necessary to decay of the teeth; that the attack is first made by them upon the *organic* tissues, upon which they feed and in which they propagate to an enormous extent, and with surprising rapidity; that the *in*organic portions of the teeth are broken down as a result of their operations. They differ beyond this point. The English scientists *infer*, if I understand them correctly, that as a result of the operations of the germs, a *peculiar acid* is secreted, which dissolves the lime-salts. Prof. Mayr, in his experiments and investigations, goes one step further, and shows that there *is no deleterious acid present* in the decayed mass, *and that the lime-salts are, substantially, remaining*, except upon the outer surface, from whence they are carried away by purely mechanical means, or similar outside influences.

For some time past I have placed nearly every tooth that I have extracted in the hands of Prof. Mayr for the purpose of obtaining a chemical analysis of the decayed masses. His report, in detail, he will give you during the session. It will suffice for my purpose here to say that the lowest per cent. of lime-salts found in the decayed masses of all these teeth, was in the case of a lower six-year molar—

crown cavity—taken from the mouth of a boy about nine years of age. The tooth was very "soft," or what is commonly termed "chalky." The decayed mass had reached the pulp. A very thin slice from the *outermost surface* of this decayed mass showed, by the most careful analysis, *40 per cent. of lime-salts* present. Sections beyond the surface showed a gradually increasing amount of lime-salts until the border line of decayed and healthy tissue was reached, when the normal amount was exhibited.

These experiments and reports constitute the most interesting and useful matter that has of late been brought before our profession; and it is something that will not "down" at a mere sneer, or cold shrug of the shoulder. Here are statements of experiments and observations made by careful men of science, and conclusions drawn from, and based upon, these experiments and observations which, if true, cannot fail to *revolutionize* much of the teachings of our literature and colleges upon the subject, to say nothing of the daily practice of the profession, or that most noble part of it, which relates to *preventive* treatment.

And here again let it be said that *very much* depends upon the truth or falsity of the theories of these gentlemen as regards *preventive* treatment. If true, then the greatest portion of the common preventive treatment is *utterly useless*. Alkaline mouth washes and dentifrices, etc., based upon the *acid* theory, are *worse* than useless—in many cases they simply *add fuel to the fire*. Acid agents would serve a better purpose. Our treatment should be *antiseptic* instead of *antacid* or *antalkaline*. In real solid fact, gentlemen, how much *absolute good* has been attained by the antacid treatment? To what extent have you, individually, *prevented* decay by *soda water, chalk*, etc.? In my own practice it has utterly failed—after the most thorough use. Soda water, etc., may, very likely, have its beneficial results in some cases; but I wish to especially emphasize the point that, in view of the scientific facts of to-day, they must be used, if used successfully, with the most careful and *intelligent* discrimination. For, as will appear further on, an alkaline condition of the saliva is as productive of *a certain class* of germ development as an acid condition is of *other* classes, and both equally destructive to the organic structure of the teeth. Consequently, the importance of a correct diagnosis and an intelligent treatment.

These experiments must be proved erroneous, or be accepted, with all that an acceptance implies. Mere assertion that "they must be

unreliable" will not do. In recognizing this to be a question of sufficient importance to warrant the appropriation of $200 to be expended in endeavoring to ascertain the "cause of dental decay," the American Dental Association are to be especially commended. In so doing, however, the "highest representative dental body" confess that the "acid theory" may be, after all, open to modification.

Allowing that the germ theory of disease in general is true, and especially as it relates to dental decay, the question quite naturally arises, how is it that a tooth exists at all, being surrounded, as they doubtless are, at all times, by an innumerable swarm of these violently voracious fellows? Again I can do no better than to quote from Prof. Mayr's statement in the New England Journal of Dentistry of July, 1882. "The existence of a tooth," he says, "is the resultant between the *outer* forces working to destroy it, and the *inner* forces active in its preservation. The tooth will be destroyed if either the *outer* forces become too strong relatively to the *inner* forces, or if the *inner* forces *become too weak*." Further on in the same article he says: "About the *septical* theory and its principles there is no longer ignorance among us. We may consider the facts as settled. But why does not healthy tissue become attacked like diseased tissue? To explain the fact, we have again to go back to the simpler forms of bioplasson, to amœba. Amœba may live in water containing bacteria; but why? Simply because they eat them up; or, to express it more scientifically, the bioplasson of the bacterium becomes a part of the bioplasson of the amœba, the latter being in excess and a more stable compound. The same will happen with a tooth; *bacteria may enter healthy enamel;* their number, from the great density and the closeness of the network of the enamel, is only small at one time, and the fibrils within, being on guard, so to say, do nothing more or less than dispose of the entering bacteria, by way of *assimilation*. Thus, as long time as the fibrils prove stronger, the bacteria will not gain entrance; but let the fibrils become weakened and they will crowd in. The danger of a part of the enamel being taken away lies in the fact that the dentine, being provided with much wider canals, the bacteria may enter in much larger number, and thus overpower the fibrils of the dentine."

As an indorsement of this position of Prof. Mayr, I will make a brief quotation from a paper recently presented by Surgeon George M. Sternberg, of the United States Army, who says: "Nature has placed in the living tissues of animals a resisting power against the

encroachments of bacterial organisms invading and surrounding them, which is sufficient for ordinary emergencies. But when the *vital resistance* of the tissues is reduced, on the one hand, by wasting sickness, profuse discharges, etc., or, on the other hand, the *vital activity* of the invading parasitic organism is increased, the *balance of power* rests with the infinitesimal but potent micrococcus."

Prof. Tyndall, in his recent masterly work on "Putrefaction and Infection," says, in connection with some experiments that have a bearing, at least, upon this question, that "Dr. Brown Sequard draws attention to the influence of muscular exercise on cadaveric rigidity and putrefaction, showing how quickly they appear in over-driven cattle, and in animals hunted to death."

Prof. Tyndall further says that "it is known, indeed, to sportsmen that a *shot* hare will remain soft and limp for a day, while a *hunted* one becomes rigid in an hour or two."

A case is cited where two sheep which had been over-driven to reach a fair were killed by the section of the carotid arteries. Putrefaction was manifest in less than *eight hours* after death.

To understand how this fact can have any connection with our subject, it is necessary to understand the laws and processes of putrefaction. If the interpretation of fermentation, given by such men as Tyndall, Pasteur, Lister, Schultze, Schwann, Helmholtz, and others, is to be *accepted*, we then have *Magitot himself* teaching the germ theory, for he says, in his fifteenth proposition of "General Conclusions," that "the *number* and *gravity* of caries are in *direct ratio* to the activity of the *fermentations* of the mouth." He also says, elsewhere, in speaking of albumen and albuminoid substances, that "it is only by the *results* of their fermentation that these effects"—dental caries—"can be produced." The "results," he of course conceives to be deleterious acids.

I am quoting Prof. Tyndall in substance when I say that if any putrefactible substance is excluded from the air, or, *if it is exposed to air from which all* GERMINAL *matter is excluded*, for any length of time, *no putrefaction will occur*. In other words, no germs, no putrefaction: or the process of putrefaction is *germ activity*.

The numerous cases cited show that this *activity* of bacterial life is markedly affected by the state of the nervous system at the moment of death. If there is physical exhaustion, the *resistance* of the tissues is very largely reduced, so that putrefaction is established at a very early moment. Whereas, if the nervous tissue—or bioplasson—is

normal at the moment of death, there remains a sufficient amount of vitality to resist the encroachment of germs for many hours. So thoroughly is Prof. Tyndall convinced of this fact that he attributes the different action of *infusions*, made from certain varieties of game, in its power to develop germs, to the accident of death. A hare, for instance, that is stole upon and *shot* he supposes will produce an *infusion* that will require a longer time to *develop* bacterial life than one that comes to his death by the chase, or is run down.

I make these quotations from Prof. Tyndall for two reasons.

First, because it confirms and elucidates the theories or statements of the two gentlemen previously quoted; and, secondly, because it offers a possible explanation of phenomena which comes within the observation of every dentist. We all know that in cases of physical exhaustion, especially where it is of long standing, the teeth decay much more rapidly than where normal conditions exist. Granting that the theories of these gentlemen are founded on facts, we have here an explanation, namely, the ever present *germ* and bacterial life in all stages of development, and a *condition* of the tissues which renders them an easy prey to the vigilant enemy.

Another quotation from Prof. Tyndall seems to have a bearing upon the cases cited by Dr. Spalding, and the numerous cases of like character.

He says, "There can be no doubt of the fact that, for the nutrition and multiplication of *bacteria*, *acid* infusions are less suitable than *neutral* or *slightly alkaline* ones. In acid infusions exposed to common air sometimes copiously develops *Penicillium*, while it *fails* to develop *Bacteria*. It is also true that exposure for a certain time to a certain temperature may in many cases *prevent* the appearance of life in an *acid* infusion, and *fail* to prevent it in a neutral or slightly alkaline one. . . . Two Bacteria-germs of equal vital vigor dropping from the atmosphere, the one into a *neutral* or *slightly alkaline*, the other into an *acid* infusion, soon *cease* to be equal in vigor. The life of the one is *promoted*, the life of the other only *tolerated* by its environment."

To perceive the full force of this quotation one must carefully study Prof. Tyndall's long series of the most delicately manipulated experiments whereby he reaches this conclusion.

Thus we may claim the authority of one of the world's foremost scientists in favor of the statement that when the neutral or alkaline *saliva* becomes the "infusion" into which the germs of *Bacteria* gain

entrance, the development is at once active and vigorous, while if the saliva is *acid* the development of *Penicillium*, *Leptothrix*, etc., will be *equally* vigorous and destructive—the latter being more decidedly of the fungoid type.

Remembering that this same author has demonstrated beyond the possibility of questioning that the dust of the very air we breathe contains, often, more than fifty per cent. of *live organic matter*, in the form of germs, or seeds of a possible organism, that only requires the proper "soil" to produce a speedy development; remembering, also, that the fluids of the mouth, *normal* or *abnormal*, do furnish the conditions favorable to development to the one class or the other, who can doubt the probability, more than that, the *certainty*, of the presence of organisms in every mouth! It is fair to submit, as the only question, the *result* of their presence; and it is this which renders the work of these scientific gentlemen referred to as of special importance and value.

Commencing only a few weeks since to gather up the results of such investigations on this subject as were readily at hand, I have been deeply impressed by the vast amount of facts, from various sources, that have appeared within a few months. Time and space only limit the array of these facts here. I can, in consequence, give you but a tithe of what might be presented. I must, however, trespass upon your indulgence while I cite a single other observer whose testimony is most important and most worthy of confidence.

For this information I am indebted to the kindness of Dr. W. C. Barrett, of Buffalo, N. Y.

Those of you who, after attending the International Congress a year ago last August, were present at the meeting of the American Dental Society of Europe, at Wiesbaden, will remember that Dr. W. D. Miller, of Berlin, read, at that meeting, a paper that was universally considered a masterly one, in support of the *chemical* theory of caries.

Dr. Barrett states that during the following February, he received a letter from Dr. Miller in which he says that owing to investigations then in progress regarding decayed dentine, he is led to modify his views somewhat on the subject of caries. He states that he has specimens that are bored through and through, not only by micrococci and diplococcus, but by baccillus, and in some cases by leptothrix.

In April following he sends to Dr. Barrett other preparations which show the dentinal tubules to be filled with micrococci and baccilli.

Among them are specimens showing places at a depth of 1½ millimeter *below* the surface of decay where the walls of the tubuli are broken through by the masses of bacteria and micrococci. Still another of these preparations, ground from dentine *perfectly* sound and very hard, show numerous germs, called in Germany "*spross pilz*"—sprouting fungus—making their way straight into the solid dentine through the enamel, apparently across the tubuli and enamel rods. He further states that he has a specimen—an outside piece—that is bored through and through by this "pilz." This is not a solitary case; he has several preparations showing their presence.

In a letter which Dr. Barrett received only last August, Dr. Miller states that he has submitted his preparations to some of the best authorities on bacteria in Germany, and they pronounce them *unhesitatingly* micrococci.

Dr. Miller is said to have hundreds of similar preparations showing the presence of bacteria, micrococci, etc., not only in the dentinal tubuli, but in their *smallest branches* also.

Those who know something of the eminent abilities of Dr. Miller, not only as a dentist, but as a chemist and microscopist as well, will regard the agreement of the results of his investigations with that of the English gentlemen referred to as of no little importance. The statement of Prof. Mayr, also, regarding the possibility of bacteria entering "healthy enamel" seems, in the light of these investigations, to be less visionary than many may have supposed.

I have thus endeavored, as briefly as possible, to *collate* some of the facts and statements, of recent origin, relating to this branch of the subject, believing that the question merits a candid and unbiased hearing on the part of the profession; and, encouraged by the hope that with the rapidly increasing facilities, as regards instruments, apparatus, etc., together with the advancement of such collateral knowledge as may aid them, our scientific men may soon be able to demonstrate beyond the possibility of doubt the truth or falsity of whatever pertains thereto. Our attention in the past, has been directed too exclusively to simply the *inorganic* portions of the teeth. It has been the *decalcification* of the teeth, the *non vital lime-salts*, etc., that has absorbed our attention to the exclusion of a proper conception of the vastly more important part that *protoplasm* plays in the life and existence of these organs; and if in addition to our studies of the *lime-salts*, we endeavor to know exactly the relations of *protoplasm* to the entire structure of the teeth, we may more clearly understand not

only their physiology, but the causes that lead to their destruction as well.

The inferences from the foregoing may be very briefly summed up as follows:

1. The usual custom of testing for acids in the mouth by litmus paper is, to say the least, unreliable. Reaction upon litmus paper may show simply the presence of *harmless carbonic* acid in the saliva, when a careful chemical analysis may *fail* to show the presence of those acids that are capable of even *abrading* the teeth.

2. The observations of the several microscopists cited agree in showing that in true caries the *organic* portions of the teeth, or protoplasmic fibrils, are first attacked by *various organisms*, and that their presence in the tubules, and their branches, is in advance of visible decay, thus destroying the *structure*, as the first step in the progress of caries.

3. Chemical experiments show an *absence* of acids, and compounds of acids with lime-salts, except phosphates and carbonates, in the decayed masses, and that the lime-salts are *present* in substantial, normal proportions, excepting upon the *outer surface*, from whence they have been washed away, or removed by mechanical or other outside influences. Hence, no *solution*, relatively, of lime-salt. That when the teeth are acted upon by acids, an *abrasion*, simply, is the result. Acids acting upon a tooth produce *combinations* of lime-salts that are *neutral*, or *inactive* in tooth destruction. For instances, acetic acid applied to a tooth produces as the first result *acetate of lime*, a perfectly harmless or neutral agent.

4. The most potent remedy, or preventive treatment, is that which results the most effectively in the conservation and strengthening of the "vital forces" of the system. Topical remedies, to be most beneficial, should be antiseptic.

5. The latest investigations in the three-fold field of histology, microscopy and chemistry point, with surprising harmony, to the *germ* theory as the most reasonable cause of dental caries. It explains more satisfactorily, and best harmonizes with, the observations of phenomena of daily practice. It makes intelligible nature's observed resistant processes, such, for instance, as Magitot's "zone of resistance." Lime-salt being much more easily soluble by the action of certain acids than the *organic* structure, it would seem a great blunder on the part of nature to fill up the tubuli with this material *if* acids were the attacking enemy. Whereas, granting the claim that *germs*

constitute the attacking forces, and that the protoplasmic fibrils are the points of attack, then nature seems to be "sound-minded" in barricading with mineral substances the entrance to the tubuli.

6. The same inference may be applied with equal force to the relative ease with which "soft" teeth are attacked as compared with "hard" teeth. If the acid theory is true, "hard" teeth should succumb as readily as the "softer" structure—in fact, more readily. Whereas, if we accept the *germ* theory, the unvarying opposite phenomenon is explainable. The vitality of a tooth is in its *organic* structure—not in its *lime-salts*—and if the vital conditions are unequal to the task of *building* solidly and strongly, the *defensive* quality of the structure is correspondingly weak, and yields to a much less vigorous attack of the common enemy.

A PLEA FOR INDIVIDUAL INVESTIGATION.

BY WILL H. JOHNSTON, BROOKLYN, N. Y.

[Read before the Brooklyn Dental Society.]

Thought is the great power that, working silently through all the years, has brought to pass at last that state of wide-spread intelligence of which we proudly boast—the civilization of the nineteenth century. The world honors more and more the man who thinks; the man who, through trial and perseverance, weaves his own crown of laurel and modestly wears it, holds higher place in the great universal heart than he who born to the purple, lives for himself alone and, dying, leaves the world no better than he found it.

Humboldt and Goethe and Luther are names that mean more to us than the greatest emperor that Germany ever had. England will base her claim to honor among nations, as being the birth-place of Bacon, Shakespere and Newton, long after the last of her kings shall have been forgotten. Vanderbilt and Gould and the Bonanza Kings occupy large space in the eye of the present, but do we boast of them, or of Franklin and Morse and Emerson? It is the "almighty dollar" that we worship in the former, and, like their treasure, their honor will fade away; but, by thought, the latter have enriched the world for all time.

But why present such thoughts at such a time and in such a place? What have Humboldt and Newton and Franklin to do with us as a society of dentists? Not much, perhaps, but he whose heart is not

stirred by the mention of such great minds, has himself not begun to think. They stand forever as beacon lights, showing the reward that awaits patient and thoughtful investigation. Did Franklin, when he first started his printing office, plan out those most wonderful achievements of his life? Did Newton, when he first began to wonder why the apple fell, vow that he would not rest until he could explain to the world that wonderful force that holds all nature in its grasp? No, indeed; they saw only what others saw, but they asked why, and to many questions they found an answer. Those that remained unanswered, we know nothing about.

A great painter, being asked how he mixed his paints to produce such wonderful effects, replied, "I mix them with brains, sir." Brains are not the gift to a few only; the trouble may be, they are so common we forget to use them. Investigation, as I understand it, is at the beginning simply thought upon the things that are daily presented to us. I take it we all see enough in six months' practice to keep our thoughts in activity for the rest of our lives. The dentist who complains of the monotony of his profession, is going about with his eyes shut. To many of us, no doubt, the little things that are constantly presenting themselves to us seem scarcely worthy of more than a passing glance. Who of us can tell which are the *little* things? What appears to us of little moment now, may make the world our debtors. Mankind to-day owes more to Dr. Barnum than to the whole family of Astors, and yet by how little a thing was the obligation incurred. Who can tell how many generations yet to come will bless the man who first instructed our profession in the use of the rubber dam?

The first thought that somewhat paralyzes effort by our young men, is that so much has been accomplished, little remains to done. This is the very thought that if we will but dwell upon, will stimulate us to greater activity. Others having accomplished so much, it should be our pride to contribute whatever we can, by faithful study and careful observation, to the further advancement of our profession.

Another depressing thought to many of us must be the limited means at our command; and yet with little, much is oft times accomplished. I remember reading somewhere of an eminent scientist calling upon the celebrated Dr. Wollaston, and asking to see his apparatus and the laboratory from which had been published so many wonderful discoveries. The doctor took him into his study and showed him an old tea-tray upon his table, in which were a few watch

glasses, test papers, a balance and blow-pipe. "This," said the doctor, "is all the laboratory I have." What a lesson is here presented to the thoughtful mind, and what a world of encouragement it may be to us. The mind that is disposed to work, will find means for the accomplishment of its purpose.

A great spur to increased activity on the part of each one of us, would be one hour's careful thought in summing up our deficiencies. It is a much more agreeable task, may be, to complacently tabulate a sum total of our attainments and, alas! a much easier one, but the result is stagnation. We really know but little which we have not proven ourselves. When an idea is advanced by some more active brother, we should at once seek to comprehend it by applying the test.

Anatomy, studied from the best of text-books is dry, and much of it incomprehensible, hardly leaving a trace in our minds a twelvemonth beyond examination day; but, with the "*subject*" before us, and the book at our hand, we see and understand something of the wonders of that complicated piece of mechanism upon which we are called to operate. Anatomy is no longer a mere word for us, but a living reality. "Nothing is knowledge for us that we have not worked out ourselves." We are hardly entitled to an opinion upon a matter which we have not come at originally by our own efforts, or in confirmation of the researches of others. How many of us are there who can thus claim what we pretend to know?

We spend the greater part of our working hours in trying to stop the ravages of decay, and, by a mechanical process, make good that which has been destroyed. If we are asked why all this labor is necessary, we refer to "dental caries," as though it were one of the laws of nature, mysterious but unalterable, of the cause and operation of which we are compelled to admit our ignorance, or at least give an answer far from satisfactory to ourselves. What is dental caries? and what is its cause? are questions that have long been learnedly discussed, and by many authors. When we consider how impotent have been the conclusions arrived at up to the present time, we may safely conclude that we have here a broad field, demanding careful thought and investigation. It is evidently a question that some time or other will be decided by a weight of evidence derived from an accumulation of statistics, rather than from the individual efforts of one man. The subject has been examined with some degree of care by Wedl, Leber, Rottenstein, and others. The results of their in-

quiries point in one direction mainly, that is, the chemical action of acids in the mouth upon the lime-salts in the tooth tissue. The two last-named gentlemen claim, also, that the rapid increase of caries, in many cases, after the dentine is exposed, is due to the growth of various fungi in the dentinal tubuli. How many of us have ever attempted to verify or disprove these theories? In fact, how many of us *know* anything about it? These gentlemen have recommended the use of weak alkalies as a preventive of caries, a course that is plainly indicated, if their theories are correct. How many of us who accept this theory have persistently insisted upon such treatment to their patients, and have ready the statistics to prove to us that he is justified by reason in his treatment. On this question of statistics, I wish to say a few words further on, but I call attention to the fact that, without them, the opinion of one man in average practice is as good as another, and it is hard to find any two who are in all things agreed. A man's action in life is generally guided by what he actually believes, but often not by what he pretends to believe. If, then, the theory of chemical action in the mouth, as the prime cause of dental caries, has taken possession of the soul of any man, he ought to begin to pile up statistics to prove it, if he can. Whether his theory is sustained or not, matters little; but his labor cannot be lost, and it may prove a foundation on which others may build.

Thales contended that *water* was the primary form of all the products of nature, and he led the thought of his time. Anaximenes, coming after him, reasoned that as water could or appeared to be dissolved into *air*, that, therefore, air was the beginning of life. Still later on, Diogenes, of Appolonia, distinguishing between air, as it was breathed into the body, and exhaled apparently the same, argued that there must be something in the air that was the life-giving principle, which he called intelligence—the soul.

Thus one builds upon another, and the temple of truth rises in proportion to the fidelity with which each performs his task.

This question of the "cause of dental caries" is one that may be debated without result for generations, or it may be answered in our time. What can we do toward its solution? Showing the position of the profession on this subject, let me quote from one or two leading men. A gentlemen of high reputation and large practice at one time in the city of Philadelphia, wrote some time since as follows: "We are perfectly satisfied that it is the solvent properties of the acrid fluids of the buccal cavity that directly cause the destruction of

the teeth, but whether teeth which are naturally good soonest decay, or those which are naturally indifferent, we are not willing positively to decide. We cannot make up our minds whether good or bad health favors most the development of those fluids which act most rapidly upon the teeth." After citing three cases in his practice, to emphasize his profound convictions in the matter, he concludes: "These cases prove nothing so far as I can understand them, except that teeth may decay more at one time than another, whether they are naturally good or not, if the fluids change." Rather poor scratching in that chaff for a hungry chick.

A prominent practitioner in Boston, writing not long ago upon this subject, after stating his belief in the "chemical reaction theory" in the subjunctive mood, could not urge upon us the use of alkaline prophylactic treatment in stronger terms than as follows: "In my practice I have been aided very much in this way, and would strongly recommend a trial of it by others. It is a simple matter, and no harm will be done, if no good; therefore, we should give our patients and ourselves the benefit of the doubt." There is evidently room for further investigation in this line.

Another subject that may develop greater skill in the use of the microscope, as well as interest in the subject itself, is that of the growth and influence upon the teeth of bacteria, leptothrix, and organisms of that class. What do we know upon this subject that may be of value to our profession? They are, I believe, always to be found where dental caries exists, but do they have anything to do as a primary cause of decay? I must say, in spite of smiles from the majority, that I believe there will the *greatest* good come from the pursuit of this line of study. I am afraid we have been too ready to accept the theory that they are nothing, mere maggots in the carrion.

The "new departure" is full upon us, and in many parts of the country does not want for warm and enthusiastic advocates. Have we attempted to prove its theories true or false? Have we given it an hour's candid thought? Twenty years ago there was published in the Cosmos an article by Dr. J. B. Harbert, advocating the limited use of amalgams. Commenting on the same, Dr. J. D. White said: "We publish the above article because it is a fair statement of a bad practice, and we are willing that both sides of this one-sided question shall be heard. We did not believe that any one in our profession, who was familiar with the history of the writers on amalgam, could venture to stake his reputation on so doubtful a foundation."

No modest hesitation there, but nevertheless I doubt not we have all advanced some steps in the direction of the "new departure" before this. To-day it is usual to denounce in the strongest terms the willful destruction of a dental pulp, and I would stop to inquire, do we not sometimes allow ourselves to be carried along on the tide of a present popular practice, until we reach an extreme position which will hardly bear cool inspection?

In an old number of the Cosmos I saw not long since a description by Dr. Taft, of Cincinnati, of his method of treating exposed pulps with nitric acid, and preserving them alive. To this the editor objects in the following language: "Thoroughly convinced by experience that half-way measures will not answer when the dental pulp is exposed, we cannot indorse, and, on the contrary, feel impelled to protest in the most emphatic manner against the plan of treatment suggested above. Years ago, after the most carefully conducted experiments, the effort to preserve the vitality of exposed pulps was abandoned as impracticable by the vast majority of thorough operators in every part of the Union. It is quite surprising, therefore, to find some of our eminent western brethren reviving an obsolete and reprehensible mode of practice." We see here that these "carefully conducted experiments" did not extend over a sufficient length of time, or he would not have denounced Dr. Taft so hastily.

These instances, hastily gleaned in a course of reading, limited and unsatisfactory to a painful degree, could be easily extended beyond the limit of my time or your patience.

What are some of the lessons we may learn from them if we will? The most important, I think, and the only one which I shall consider at this time, is the great advantage that would accrue to our profession from a long and constantly accumulating series of statistics. Take, for instance, the question first mentioned—the cause of dental caries. It is a great pathological problem of which at present we have but one or two ideas. It is one that necessarily demands accurate statistics before any satisfactory deductions may be drawn. There are twelve thousand dentists in this broad land. If only one in ten could be induced to examine with some care every mouth that comes under his observation, and with equal care note down its general condition, the reaction of fluids there found, together with pathological conditions more or less uncommon, who can estimate the value of a year's united effort?

There are, say, fifty members of this Society. Suppose each one of

us could be so fired with zeal for experiment and investigation as to gladly contribute the labor necessary to the carrying out of such a plan, how long, think you, it would be before the Brooklyn Dental Society would be quoted as a source of information by all inquiring men? Such a plan requires some effort and some thought, but at the end of a few months, even, I think we would cease to hear our members remark that "we were too near New York to have interesting meetings of our own."

There is another argument in favor of society action. Solitary labor is to the most of us burdensome in the extreme, but of all the incentives to continued effort, the assured sympathy of brethren and friends is one of the strongest. Under its encouragement such thought and care as I have suggested would soon become one of the pleasures of our daily life.

There are many other subjects upon which a systematic collection of statistics would shed much light. It is usual at this time, I believe, to cry down all that practice which looks to the destruction of the dental pulp (including root fillings), and I have heard some contend, if the pulp were destroyed half-way up the root, that which still retained life should be preserved. Somehow, I feel that oftentimes men, under the excitement of argument, and a desire to sustain a theory, talk a little more wildly than they would if we could show what had really been the practice of our members, and what their relative degree of success for the past year. And who would be able to resist the deduction drawn from ten years of such a record among us?

Now and again the question comes up, "What shall we do with the money in our treasury?" I believe the largest dividends may be realized by the investment of a small sum each year for the encouragement of investigation and the collection of statistics. Blanks could be prepared by the secretary or by a committee appointed for the purpose, arranged for reports upon such lines of investigation as the members might desire. Such a blank, prepared by a brother well acquainted with the latest thought advanced in each line, might prove a great help in directing in the proper channel the observations of our younger members.

A secondary result of great value, arising from such a course, would be, in my opinion, the familiarizing ourselves with a habit of close observation of all things, and a readiness in description, which is a rare quality indeed, except as developed by just such a course of

study. Huxley, in speaking of the necessity of careful observation and clear description in scientific studies, calls attention to the difficulty one would have in trying to give an idea of so simple a thing as a rose or the plainest weed to one who had never seen such a thing. To develop this power in most of us needs only an earnest endeavor to understand what we see and a modest desire to impart to others what little scraps of truth we may have accumulated from time to time.

May we all strive more and more toward that perfection in little things, that the sum total of our lives may at the end be pronounced *good*.

REMARKS OF DR. W. C. BARRETT UPON DENTAL LITERATURE, BEFORE THE NEW ENGLAND DENTAL SOCIETY. BOSTON, OCT. 6, 1882.

I am asked to say something about the staff upon which our profession leans. Without a literature, men are barbarians. Without a literature, dentistry degenerates into mere handicrafture. Before the day in which Cadmus invented letters, Greece was the home of petty tribes of savages. What distinguished and made forever memorable that early Egyptian people, with their wondrous civilization, but the fact that they, of all their contemporaries, had a written language—aye—three written languages? What marked the golden days of Pericles, of Solon, of Socrates, of Thucydides, but the high tide of literature? What were the palmy days of Rome but those of Virgil, and Pliny, and Cicero, and Horace? Where were the fame of Agamemnon, and Achilles, and Ajax, and Nestor, but for the fact that Homer lived? And to come down to more modern times, what were the golden days of England but those of Bacon, and Addison, and Milton, and Shakespeare? Nay, to strike yet nearer home, what names have thrown greater luster upon American history than those of her literary men; her Longfellows, and Irvings, and Hawthornes, and Whittiers, who shall be known when her warriors, the successful murderers of their fellow-men, shall have sunk into oblivion?

Dentistry has made wonderful progress in the past, because we have had a class of writers who, knowing what they desired to say, had the happy faculty of expressing it tersely, impressively. The pen of Harris was more powerful than his probe or excavator. McQuillen made a deeper impression upon the minds of his fellow dentists than he did upon his patients. Why need I go on to mention Bond, Taft,

Arthur and others? The sum of the whole matter is, we get a clear picture of dentistry by looking in the mirror of its literature. Every feature is reflected therein, and when our letters are at a low ebb, we may be sure the profession is not above the same level. I will not extenuate, nor set down aught in malice. We have a few pretty fair text-books, but not half as many as we should have. If one desires to write up any subject in dentistry, when he looks about him for his authorities and quotations he is quickly reminded of a want which cries aloud. We have a fine array of dental journals, and they are a fair representation of the profession, but with two exceptions, possibly three, they are owned and practically controlled by the mercantile interest in dentistry, and are mainly published as advertising mediums.

The part of each which is devoted to the profession is not what it would be if dentists were more communicative, but it is pretty well as compared with other professions. Our journals are in the main not very deep, but they are broad. It is a shame to us of the rank and file that so many articles are necessarily admitted as padding—to fill up. There is a great deal of borrowing from each other, and not enough of original essays and primary thought. How can there be, when dentists are so backward in preparing articles—and when the journals pay nothing for the better class of writers, and must therefore put up with what they can get? There is a deal of red rubber and amalgam talk, and not enough of basal principles, but the journals are struggling toward higher ground. The old seniors, like the Register, the American Journal, and the Cosmos, hold their own fairly well among the younger ones, though the indications in the juniors of young blood, later investigation, and fresh thought, it may be plainly seen, nettle the old ones at times. Altogether we have no reason to blush very deeply for our literature. It would be better if there were less of dental depot influence (I do not intimate dictation), for the light is not becoming more manifest when, practically, the depots openly combine against the dentists, and not a journal raises the voice of warning, but in the main our periodicals are as unshackled as, in the nature of things, they well can be.

What is the outlook for the future? That depends upon the progress of the profession. If dentists are thinking, reflecting men, our muses will show it. If the profession is everywhere given up to the "auri sacra fames," the cursed thirst for gold, we shall soon have cause to hang our heads for our humanities, because the stream cannot rise higher than its source, and professional literature will remain

at the level of the body with which it is connected. It must be remembered that every profession makes its own literature. Editors write few of the articles which they publish. Look through the list of our journals, and see what proportion is conducted by practical, working dentists. The busy bees of the profession have little time for composing homilies upon the flowers which they are engaged in rifling of their honey. But if practical dentists neglect the journals altogether, we shall soon see them what some of the more prominent foreign dental periodicals are to-day—filled up with accounts of the success of the dentists in crowding themselves into medicine, and exhibiting their inability to stand alone; with long narratives of legal squabbles; the platitudes of mutual admiration societies; of meetings where a paragraph suffices to record all the scientific discussions, while pages are devoted to an account of the dinner; ten lines dedicated to the brain, ten pages to the stomach. I like good eating and drinking, but my God is *not* my belly, however much appearances may be against me.

The Literature of Dentistry, let me repeat, can only reflect the status of the profession. If dentists are wholly given up to greed and money-making, the journals will be devoted to advertising. Hah! I almost wish I had not said that, for it reminds me that I counted the pages of the last dental journal received before leaving home, and —let me say it in a whisper—there was more space devoted to advertising than to dental literature. It was a depot journal, however. I will say for the credit of the only dental journal which New England possesses, that I did the same for its September number, and found the reading matter was more than four times the advertisements; so I conclude that is not mainly published as an advertising sheet. Well, advertisements are legitimate enough, but I don't like to see our very altars inscribed—"Try Dr. Quack's new patent, improved, non-shrinkable, Stannous gold, New Departure alloy; in proportion as teeth need saving, amalgam is the only material proper to save them, and mine is the single, solitary, genuine, Simon-pure, Old Original Jacob Townsend, take-no-other-only-four-dollars-an-ounce article." Such literature as that, whether in book or journals, private conversation or dental society discussions, is scarcely creditable to the profession, and those who last summer attended the International Medical Congress in London had it frequently thrown in their teeth.

The only way to sustain a creditable literature is for every intelligent dentist to contribute his mite. There is not a practitioner

worthy the name, who has not stored in his memory some aphorism that others need to be reminded of; whose experience, in some one instance peculiar to himself and unique, should not illumine and instruct his brethren. There are a few gifted men who might perhaps contribute volumes. Not one of us but could enrich our literature with a paragraph, at least. A thought which may occur to us, if properly recorded, if garnered in the grand storehouse of letters, may feed some hungry soul, and stimulate a fainting mind to renewed exertion. Neglected, it is as the idle wind which fanned the brow of yesterday, and to-day is not. Brethren, don't forget the dental journals.

PORCELAIN AND METAL "CAPS," "STOPPERS," ETC., AS EMPLOYED IN THE CASE OF DECAYED TEETH.

BY GEORGE H. PERINE, D. D. S., NEW YORK.

In the September number of the *New England Journal of Dentistry*, editorial reference was made to the inquiry of a correspondent concerning the subject indicated by the title of this paper. This method having come within my own practice, and because it has fallen to me to possess certain special information concerning it, I very gladly make the attempt to furnish the correspondent of the New England Journal of Dentistry the information desired.

In 1862, Dr. B. Wood suggested to the late Dr. S. S. White an idea of his own in this direction, which, so far as I have ever known, takes precedence of all other in point of time, so far as it concerns *porcelain* or other non-metallic substances employed as "caps." His idea was to make caps and crowns of tooth-body material, of different shades, applying them by means of grooves and slots, or by platinum pins baked in. These "caps" and "crowns" were to be grafted on the remains of a tooth by means of a plastic filling, thus restoring the form and beauty of decayed teeth. The conception was not adopted at the time, but since then it has to some extent come into general practice, and manufacturers are supplying "caps" and crowns of this character to those who desire them.

In 1875, Dr. J. Porter Michaels, then of Vienna, Austria, now of Paris, France, assigned to me for the United States certain inventions of his own relating to dentistry, among which was a process for filling teeth, for which, on July 24, 1875, I filed a caveat in the United States Patent Office. The nature of this method I made public in one of the dental journals in 1876; and, for the benefit of those who are

not familiar with it, and because it is in the line of the question I am endeavoring to answer; and, morever, that Dr. Michaels may be awarded the credit that is justly due him for the invention—I will briefly recapitulate the details of this mode of practice—the cuts which I furnish clearly illustrating the whole subject.

It will be understood, in the beginning, that while this plan is designed to do away with the trouble and annoyance of the ordinary building-up plan, the operator should nevertheless see that no point in the proper preparation of the tooth for filling is in any way slighted.

This method is used in connection with a plastic, non-conducting material, applied in the usual manner, and with proper care. The plastic filling is now to be protected by the use of a perfectly fitted "cap" of gold plate, pearl or porcelain. To explain the application of this "cap," I will remark that, in preparing the tooth for filling, an instrument should be used sufficiently large to reach the healthy part of the tooth surrounding the cavity to be filled; with the instrument (Fig. 1), a perfectly circular cavity is formed, care being taken not to approach too near the lining pulp or nerve.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

The instruments illustrated in Figs. 1 and 2 may be used on any of the dental engines.

After the cavity is properly prepared for the reception of the stopping, with the second instrument (Fig 2), there should be cut around the edge of the cavity on the external surface of the tooth, a groove, or gutter, in which to set the gold "cap" (Fig. 3).

On the under side of the gold "cap" are heads, or hooked staple-shaped wire, which sink into the plastic stopping with which the cavity has been filled, and thus serve to anchor the cap ready for finishing whenever the material has hardened—or cooled. If Hill's stopping be used, the cap must be warmed before being applied, by means of the instrument (Fig. 5), by which it is carried to its place.

Fig. 5.

It will be found that the proper adjustment of the cap in place depends upon the force used in pressing it home upon the plastic stopping. It will also appear that the pressure will force the surplus material out under the edges of the cap and thus, on its hardening, or cooling, will complete the union between the cap and stopping. Of course, the necessary force must be applied with great care and judgment. The instruments with which this part of the operation is performed are illustrated in Figs. 6 and 7, which, being larger than the external cavity, rest, as they are pressed home, upon the surrounding edge, the centre of the cap being thus prevented from being forced too far into the cavity—the result of which would be the lifting of the cap from the groove or gutter before the material had set.

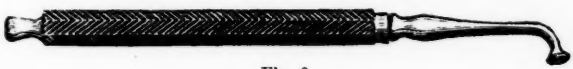

Fig. 6.

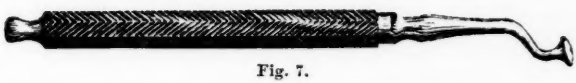

Fig. 7.

Gold caps can be made in different sizes, to obviate the necessity of using such as would be larger or smaller than the nature of the case requires. Fig. 4 illustrates a gold cap with a flange border. After it has been placed in position, a rope of gold foil may be packed in and around the border of the cap, and the gold wire above the cap, by which it has been carried to its place, may now be cut off, and all finished and burnished down.

Where the surface upon which the cap is fitted is irregular, the cap and gold foil may be burnished down to fit into the inequalities, rather than use the file to remove them.

The application of the porcelain or pearl caps is the same except the securing of them, which is effected by dove-tailed projections or platinum pins.

The great merit of this mode of filling teeth over metallic filling consists in the freedom from thermal changes in the material, and all the advantages of a metallic crown, without tediousness to the patient and operator, or any of the disadvantages which are liable when the metal approximates to the pulp. It has also decided advantages over the method of filling by building up with gold foil—even when this is underlaid with plastic filling.

It has come to my knowledge that certain persons, who have chanced to learn of this method of filling teeth, have laid claim to originality in using it, and have even asserted that they had invented it. I trust that what I have here written, besides setting forth subsequently the nature and value of the method itself, may set at rest the pretensions of these charlatans, and place the credit where it justly belongs, viz: with Dr. B. Wood and Dr. Michaels.

EDITORIAL.

THE NEW ENGLAND DENTAL SOCIETY.

The Merrimack Valley Dental Society, which held its twentieth annual meeting at Boston, October 5th and 6th, celebrated the occasion by changing its name to that of the heading above. The meeting was one of importance and of much interest to a large number of dentists from all parts of New England, and the new name which the old Society assumes upon reaching its "majority," is an appropriate one, inasmuch as, for many years past, the roll of membership contains names of dentists from all the New England States excepting, possibly, Vermont and Connecticut.

The Merrimac Valley Society has had a notably successful history for twenty years past, and if the late meeting is to be accepted as an augury of the future, no less, relatively, may be expected of it in the years to come. It takes this new start in life with an active membership of about one hundred and fifty, and a balance of some $350 in its treasury.

By an amendment to its by-laws, meetings are to be held annually instead of semi-annually, as heretofore, which seems to us a mistake, unless our New England *State* societies can be made more efficient, and infuse themselves with an emulation of similar societies in other parts of the Union to a much greater and more uniform extent than has been the case in the past.

The programme of this meeting showed that the society possessed a live, active Executive Committee, and one that understood the supreme importance of looking well after details.

The larger matters are more apt to take care of themselves, but if the little things are allowed to get our of gear, an embarrassing stand-

still of the entire machinery is often the result. The meeting was promptly called to order at the appointed time, and the first session occupied by matters of business—admission of new members, etc. Some little friction was caused when it was learned, by quite a number who had responded to "a cordial invitation is given to all respectable practitioners in New England to join us, and assist in making this society a valuable aid to the advancement of the dental profession in New England," that a *by-law* required that whoever desired to "join" should be the possessor of a degree from certain organized institutions. Certain gray-haired gentlemen, with some brains and less caudal appendages, were at first inclined to regard the "cordial invitation" and the by-law as a little inconsistent, but were easily induced to believe the matter an oversight, and all passed off pleasantly as, of course, similar things must under the cordial good feeling and excellent spirit of the officers and members of this excellent society.

Perhaps this is as good a place as any for us to say that we have often thought that it was a pity that some of our societies seem to be managed so much by the colleges and those in their interest, instead of the profession as a profession, and for the best interests of the profession, present and future. Attempted arbitrary or compulsory legislation, by a class, and that class a minority, does not seem to us the best and most successful method that might be adopted to elevate the profession as a whole, especially in those states where the profession has no special legal status. Those who are wiser than their fellows could do more and better in the direction of an elevation of the profession as a whole, could more readily "leaven the whole lump" by some other course than to withdraw from the "lump" and surround themselves by those only who possess, or imagine themselves to be possessed of, an equal amount of wisdom and feigned respectability. We must confess to a very strong leaning toward the plan adopted by some of the medical profession in many of our western states—a simple convention of physicians, without constitution, by-laws, or code of ethics, open to all schools and no schools; where every man who has an idea, fact or principle, can claim an equal right to the floor and a respectful hearing. He must, however, expect "no quarter" from a critical sifting of the same. These men do not seem to be afraid of the truth, coming from whatever source, and can trust truth to meet error in open combat. We are not opposed to the colleges by any means, nor do we argue against the obtaining of

"degrees." The more, the better, providing they mean anything. But we cannot agree with many who seem to regard the simple possession of a degree as the sure evidence of a superior respectability or reliability. It is *knowledge*, obtained from any and all sources, that should mark a man as preëminent in his calling. And these men, it seems to us, can more effectually inspire others to seek the higher plane by *personal contact* with those they seek to elevate than by secluding themselves within the walls of an assumed class superiority. In other words, the *moral* influence is greater than the *legislative*. This is upon the supposition that societies are formed for the benefit of the *profession*—not for a select few. That something like these views were entertained by not a few of the active members of the New England Society was evidenced in many incidents during the late meeting—one of which was an introduction of an amendment of the by-laws practically annulling the clause referred to, and the evident uneasiness of many under the existing restriction.

The afternoon session of the first day was wholly given up to listening to the address and the exemplification of the subject by numerous experiments, by Dr. W. C. Barrett, of Buffalo, New York. The paper was upon the "Physiology of Anæsthesia," and was illustrated by a large number of very interesting experiments, showing the physiological action of the various anæsthetic agents. One of these experiments proved that the claims of certain prominent authors are not founded upon facts, inasmuch as it was demonstrated that nitrous oxide gas "kills" nearly as quickly as carbonic acid gas. Whence, therefore, the claim that this gas "is a supporter of life?" Dr. Barrett seemed "perfectly at home" with the scalpel, and, as a clinical lecturer, on this occasion, at least, was voted a complete success. Could we reproduce in the columns of the Journal this address, with the accompanying experiments, we should do the profession a good turn that would be highly appreciated. We hope to print the paper at an early date, but for the experiments we must urge that reference be made to the "*operating table*"—and, by the way, here's a hint to other societies. Let the *operating table* be transferred more frequently from the colleges to the societies; and, when you do so, Dr. Barrett is a good man to wield the knife. At the adjournment of the afternoon session, the society, with its invited guests, were seated at a collation at the Parker House. An hour and a half spent here in a social and informal way served as a pleasant introduction to the regular evening session, which opened at 8 o'clock, and was devoted to

the reading and discussion of a paper by Dr. C. T. Stockwell, of Springfield, Mass. Subject: "The Etiology of Dental Caries. Acids or Germs; Which?" The paper will be found in this number of the Journal.

Prof. Charles Mayr, also of Springfield, gave the results of some extended chemical experiments with decayed dentine, bearing upon the subject. The essayist took the ground that the latest discoveries in the three-fold field of histology, microscopy and chemistry, show that acids play an unimportant part in caries, and that "*germs*" are the active cause of true dental decay. Prof. Mayr's experiments were also confirmatory of this conclusion, showing, relatively, no *solution* of lime-salts, and the presence of substantial normal proportions of lime-salts in the decayed masses. The discussion that followed showed that a considerable interest was awakened in the subject.

The first business in order at the morning session was the reading of a paper on the subject of "Regulating Teeth," by Dr. Thomas Fillebrown, of Portland, Me. This paper mainly served as an introduction to remarks upon a system of regulating teeth, by its author, which was illustrated by a large number of "cases in practice," with a description of the variations of the application of the system to particular cases. A general discussion followed upon the subject of "Irregularities," and various methods of correcting the same, prominent reference being made to the "Coffin" method of "expansions." Following this subject, came a paper by Dr. Barrett, upon "Dental Literature." This paper, also, may be found elsewhere in this numnumber.

The election and induction of officers for the ensuing year, and fixing upon a place of next meeting, closed the sessions.

The officers elected were as follows:

President, Thomas Fillebrown, Portland, Me. Vice Presidents, William Barker, Providence, R. I.; James Lewis, Burlington, Vt. Secretary, A. M. Dudley, Salem, Mass. Treasurer, G. A. Gerry, Lowell, Mass. Librarian and Microscopist, G. F. Waters, Boston, Mass. Executive Committee, J. B. Coolidge, Boston; W. H. Tillinghast, Providence; E. B. Davis, Concord, N. H.; J. W. Curtis, Brunswick, Me.; A. W. Buckland, Woonsocket, R. I.; S. D. Hodge, Burlington, Vt.

The next meeting will be held at Providence, R. I., in October, 1883.

A vote was passed instructing the Executive Committee to secure some prominent member of the profession, outside of the society's membership, to give the annual address at that meeting.

Why do not some of the live dentists of Boston and vicinity "*forage*" in that immensely interesting field, the Peabody Museum of American Archæology and Ethnology, at Cambridge? There is much material for statistically inclined individuals among the large collection of skulls to be found there from all parts of the world. Prof. Putnam will, we are positive, be glad to afford any reasonable amount of the valuable assistance he is so capable of giving. Having been collected for the benefit of science, science should not neglect the opportunity.

As there seems to be much difficulty in obtaining just the right preparation of eucalyptol for dental purposes of druggists, we are glad to call attention to an advertisement relating to this drug, in this number. Having used, for some time past, eucalyptol and gutta-percha in root canals, as described by Dr. Parmele in the August number, we can most heartily indorse this method of practice, both for its ease in manipulation and correctness of principle—it being a reliable *antiseptic*.

On page 288 of our September number, in the speech of Dr. Field, we forgot to insert after interest, "at the meeting in London," and after my presence, "in London."

Every member at a society meeting who is wrongly reported will confer a favor on us by sending us a correction, but it must be a really wrong passage, not one that he might have worded differently, to which he applies his criticism.

SOCIETIES.

The fifteenth annual session of the Brooklyn Dental Society was held October 9, 1882.

Officers for ensuing year:

President, Dr. A. H. Brockway.
Vice-President, Dr. F. W. Dolbeare.
Recording Secretary, Dr. C. P. Crandell.
Corresponding Secretary, Dr. W. H. Johnston.
Treasurer, Dr. F. C. Walker.
Librarian, Dr. L. G. Wilder.

C. P. CRANDELL, *Recording Secretary*,
508 Clinton Avenue, Brooklyn, N. Y.